

Chamber of Deputies which, as is known, is to be transferred to Paris in November next, there to hold its sessions, so long as the Parisians do not oppose it by a revolution.

AT the Stuttgart meeting of the International Geodetic Association in 1878, M. Faye suggested a method of avoiding the flexure of a pendulum-support, viz., that two similar pendulums should be oscillated on the same support with equal amplitudes and opposite phases. The idea was thrown out on the spur of the moment, and was not received with very warm approval. By a mathematical discussion of the method in a paper to the U.S. National Academy (*Silli. Journ.*, August), Mr. Peirce endeavours to prove that the suggestion is as sound as it is brilliant, and offers some peculiar advantages over the existing method of swinging pendulums.

AT the International Alpine Congress at Geneva Prof. A. Favre pointed out the necessity of making measurements of glaciers. The retrocession of glaciers has been general during the last twenty-five years. Prof. Favre is of opinion that this retrocession period will come to an end after some time, and will be succeeded by a period of advance. The German and Austrian Alpine Club, at its last general meeting at Saalfelden, resolved to make the measurements in question on all the glaciers of the Austrian Alps.

THE third volume of Dr. Karl Russ's work on foreign domestic birds, containing the natural history and cultivation of parrots, has just been published by C. Rümpfer, of Hanover.

A NEW oil plant (*Lallemantia liberica*) has been acclimatised on the fields of the Agronomical School at Cherson (South Russia). It belongs to the *Labiata* family, and is very similar to *Dracopcephalum*. The herb attains a height of $1\frac{1}{2}$ to $2\frac{1}{2}$ feet and bears some 2,500 seed-grains, which give a most pure oil, applicable even for culinary purposes. The seeds of this originally Persian plant were first sent to Cherson by Prof. Haberlandt, of Vienna.

WE learn that M. Europeus still continues his most interesting researches into the prehistoric Finnish population of North-Western Russia. During last summer he explored the *koorganes* (mounds) of the province of Olonets, and on the banks of the Oyak river he discovered many bronze implements similar to those brought in by Ujfalvi from the banks of the Irtysh in Siberia. The remains of the Korels in the district of Olonets throw a new light on the geographical distribution of this people. M. Europeus has arrived at the conclusion that during the first centuries of the Christian era the whole of North-Eastern Europe and the north of the Scandinavian peninsula were peopled by tribes of Finnish-Hungarian and Finni-h-Ugrian origin, who formed an extensive and strong state. Only the shores of Lake Onega had a purely Finnish population. All skulls in the *koorganes* of the region formerly occupied by Finns, are of the brachycephalic form.

COUNT T. SALVADORI'S great work on Papuan ornithology, "Ornitologia della Papuasie e delle Moluche," is in a forward state, and it is hoped that the first part (containing the Accipitres, Psittaci, and Picariæ) will be ready about the end of the year. The second part will be devoted to the Passeres, and the third to the remaining orders. The total number of species contained in the work will be about 900, the area embraced being the whole of the Austro-Malayan sub-region, with the exception of Celebes and the Timor group of islands.

A RAILWAY is now being built between Tiflis and Baku, and is expected to be completed in about four years.

WE have received the fourth volume of the *Bulletin* of the Société Ouralienne, i.e., the Natural History Society of Ekaterinburg, Russia. The volume contains some interesting data on

the flora of the Ural Mountains, by M. G. O. Clerc; also some notes on rain-gauges and on the quantity of rain and snow which falls at Dolmatoff (average computed from observations extending over fourteen years), by the same. Another valuable contribution is by M. N. P. Boulytcheff, and treats of the flora and the fauna of the Irbit District. All these papers are given in the Russian original and in a French translation. An original German paper is by Dr. J. Hann, on the daily course of magnetic declination in Russia, but only the Russian translation is printed.

THE Congress of German Horticulturists which took place at Cassel this year will meet at Bremen next year.

AT South Arcot (Presidency of Madras) experiments have been recently made with the fibres of aloes, which grow there in abundance, with a view of preparing paper from this material. A product was obtained which considerably surpassed the ordinary Indian paper in quality, and it is now intended to make the experiments on a larger scale in this country.

THE St. Gothard tunnel, which will measure 14,920 metres when completed, has now reached a length of 13,229 metres. It is hoped that by the beginning of December next the gigantic work will be finished.

THE additions to the Zoological Society's Gardens during the past week include a Guinea Baboon (*Cynocephalus sphinx*) from West Africa, presented by Mr. F. Naylor; a White-fronted Capuchin (*Cebus albifrons*) from South America, presented by Major H. L. Gleig; a Black-faced Spider Monkey (*Ateles ater*), two Black Tortoises (*Testudo carbonaria*) from South America, two Martinican Doves (*Zenaida martinica*) from the West Indies, presented by Capt. Henry King; a Plantain Squirrel (*Sciurus plantani*) from Java, presented by Miss Lizzie Casey; an Indian Jackal (*Canis aureus*) from India, presented by Mr. Thos. Thursfield, M.R.C.V.S.; a Demeraran Cock of the Rock (*Rupicola crocea*) from Demerara, presented by Mr. R. S. Fraser; a King Parrakeet (*Aprosmictus scapularis*) from New South Wales, presented by Mr. Geo. Wood; a Red and Blue Macaw (*Ara macao*), a Red and Yellow Macaw (*Ara chloroptera*) from South America, deposited; an African Brush-tailed Porcupine (*Atherura africana*) from West Africa, a Vulpine Squirrel (*Sciurus vulpina*, var. *capistrata*) from North America, purchased.

THE BRITISH ASSOCIATION REPORTS

Report of the Committee for exploring Caves in Borneo. Drawn up by Dr. J. Evans, F.R.S.—The Committee report that with the grant of 50*l.* from the Association, a similar grant from the Royal Society, and a farther sum of about 200*l.* from private sources, they have been able to prosecute an examination of various caves in Borneo, under the superintendence of Mr. A. S. Everett, who has devoted himself to the task for a period of nearly nine months.

The final report upon his work has not yet been received, but it appears from his letters and from the specimens which have been transmitted to this country, that nothing of special interest either from an anthropological or a geological point of view has resulted from his explorations. The animal remains discovered have all been of recent species; the human bones are probably of no great antiquity, and none of the few objects of human manufacture which have been found can be regarded as of palæolithic age.

Pending the arrival of Mr. Everett's final report it appears needless to enter into details; but it may be mentioned that upwards of twenty caves appear to have been explored, in a more or less complete manner, and the principal objects found, after examination by some of the members of the Committee, have been forwarded to the British Museum. Although the examination of these caves has not, as was hoped, thrown any light upon the early history of man in that part of the world, it is still satisfactory that the examination should have been made

and the character of the cave-deposits ascertained by so competent an observer as Mr. Everett. The evidence obtained, though negative, is not without value, and those who are specially interested in cave-explorations, and who have so liberally assisted in the present instance, cannot be reproached with not having availed themselves of the opportunity afforded by Mr. Everett's presence, of obtaining farther information as to the contents of the Borneo Caves.

It may be added that though for the most part the objects secured were unimportant, there were among the cave-deposits a number of shells of land and freshwater mollusca, which have been examined by Col. Godwin-Austen, and have proved to belong to at least 25 genera and 40 species, some of which are apparently new. Mr. Everett has been requested to devote some attention to collecting a larger series of these shells, but owing to the difficulties of postal communication it is possible that the request may arrive too late.

The Committee propose to communicate Mr. Everett's final report, together with any observations which seem called for on the specimens which are still to arrive, to the Royal Society.

Underground Waters.—The fifth report was presented of the Committee appointed in 1874 to inquire into the circulation of underground waters, and the extent to which they may be made available for the water supply of towns and districts. The Committee state that, as the objects of the inquiry become more widely known, there is increasing inclination shown by engineers and contractors to impart information, which accrues from day to day, and that they consider it desirable to continue their labours until it becomes the duty of some Government department to undertake the charge. They desire to extend their inquiry beyond the Permian, Triassic, and Jurassic rocks to all permeable formations yielding supplies of potable waters. A large amount of valuable information has been collected in the Midlands and in other districts, of works in progress which will be reported on next year. The attention of the Reporter of the Committee (Mr. De Rance) has been specially directed to ascertaining the areas of pervious rocks, in each of the river basins of England and Wales, and of the areas of impermeable rocks overlying permeable formations, and forming "supra-pervious" areas, together occupying an area of more than 25,000 square miles, and capable of yielding an amount of water far in excess of the quantity required for manufacturing and potable purposes. The impermeable nature of the Severn river-basin is alluded to, and the consequent danger of abstracting a large volume of its waters for Liverpool water supply commented on.

Report of the Anthropometric Committee.—This Committee had been appointed for the purpose of continuing the collection of observations on the systematic examination of heights, weights, &c., of human beings in the British Empire and the publication of photographs of typical races of the empire. Considerable progress had been made during the past year, and returns, giving the birth-place, origin and sex, age, height and weight, colour of hair and eyes, girth of chest, strength of arm and eyesight, of pupils at Westminster and other schools, London policemen and letter sorters, workmen, rifle volunteers, soldiers and criminals, had been obtained. By this means the Committee were put in possession of nearly 12,000 original observations on the main question of weight and height in relation to age, in addition to 50,000 already collected. The Committee submitted a series of tables made up from the information contained in the returns. From these it was shown that the London letter sorters were the lowest in height, the average heights between the ages of 20 and 35 being 64 to 67·1 inches. The letter sorters were also at the bottom of the weight table, their average weights in lbs. being 122·5 to 139·9. The metropolitan police were at the head of both lists; height 69·2 to 71·5 in., and weight 162·5 to 182·7 lbs. Other tables were given, showing that the average height and weight varies with the social position and occupation of the people, and that to obtain the typical proportions of the British race it would be necessary to measure a proportionate number of individuals of each class. Taking the census of 1871, they would find that a model community would consist of 14·82 per cent. of the non-labouring class, 47·46 per cent. of the labouring class, and 37·72 per cent. of the artisan and operative classes. The nearest approach to such a representative population in a limited space would be found in some of the larger county towns, such as York, Derby, or Exeter. The tables demonstrated that the full stature is attained in the professional class at 21 years, and in the artisan class between 25 and 30 years. American

statistics showed that a slight increase in height takes place up to the 35th year. The growth in weight does not cease with that of the stature, but continues slowly in both classes up to about the 30th year. The report concluded by referring to similar investigations which are being made in other countries, and the coincidence of the several inquiries led to the hope that information of great value might in due course be elicited.

SECTION A—MATHEMATICAL AND PHYSICAL

On Secular Changes in the Specific Inductive Capacity of Glass, by J. E. H. Gordon, B.A.—At Christmas, 1877, I made some determinations of the specific inductive capacity of optical glass by a method which has already been fully described both before this section and elsewhere.¹

At the end of July, 1879, I commenced a repetition of the experiments, using the same slabs of glass, and was surprised to find a large increase in the specific inductive capacity in every case. In some cases the increase was as much as 20 per cent.

The following is a table of the results:—

Specific Inductive Capacity of Optical Glass

	Christmas, 1877	July and August, 1879
Double extra dense flint	3·164	3·838
Extra dense flint	3·053	3·621
Light flint	3·013	3·443
Hard crown	3·108	3·310

The arrangement of the apparatus, including the coil and rapid break, was precisely the same as in my earlier experiments. The electromotive force was as nearly as possible the same, and experiment has shown that moderate variations in it do not affect the results.

The differences observed might have been caused by any one of three things:—

1. By error in the 1879 experiments.
2. By error in the 1877 experiments.
3. By a change in the specific inductive capacity of the glass between Christmas 1877 and July 1879.

[The author, after showing reason for the rejection of (1) and (2) is led to the conclusion that in the course of a year and a half an actual change has taken place in the glasses, which is shown by a considerable real increase in their specific inductive capacities.] To complete our knowledge of this new phenomenon we require a series of monthly observations, extended over perhaps a period of several years. I shall hope to be able to give the results of another year's experiments at the next meeting of the Association.

These experiments have some importance as regards Prof. Clerk-Maxwell's electro-magnetic theory of light. In a recent lecture² I ventured to suggest "that it is quite possible that the relation between electric induction and light exists—namely, that they are disturbances of the same ether, but that there is some unknown disturbing cause affecting the electric induction."

Possibly a clue to the nature of this disturbing cause may be found in the fact, that the specific inductive capacities are affected by some of the changes which chemists tell us are constantly going on in glasses, but that these changes do not affect the refractive indices.

SECTION B—CHEMICAL SCIENCE

Mr. W. Chandler Roberts, F.R.S., Chemist of the Mint, read a paper *On some Experiments with the Induction Balance.*—He stated that the instrument, which we owe to Prof. Hughes, the discoverer of the microphone, appeared to be one of no ordinary importance, and although the experiments about to be described were far from complete, they possessed sufficient interest to warrant their being submitted to the Section. He then described and exhibited Prof. Hughes's instrument, showing the extreme delicacy by which changes in the induced current were indicated by the microphone and telephone.

The relative values of different metals, as indicated by the induction balance, do not accord with the values usually accepted as representing the relative conductivities of the respective metals, and this being the case, Mr. Roberts had ascertained what rela-

¹ *Report Brit. Assoc.*, 1878; *Proc. Roy. Soc.*, 191, 1878; *Phil. Trans.*, 1879; "Four Lectures on Electric Induction," delivered at the Royal Institution (Sampson Low and Co., 1879.)

² Royal Institution, February 6, 1879.

tion the indications given by alloys, when under the influence of the induced current, bear to their electric conductivities.

The experiments on a comprehensive series of alloys proved that, in the case of alloys of certain metals, the induced-current curves closely resembled those representing electric conductivity, but that in certain other cases the induced current revealed differences that had hitherto escaped observation. As an example, Mr. Roberts alluded to the curve of the copper-tin alloys, in which there is a sudden break between the points representing two alloys, which only vary by a single equivalent, or by 6.4 per cent. of copper. These two alloys are widely different in colour, fracture, density, and structure, and the induction-balance at once afforded evidence of a marked difference not shown in Matthiessen's curve of electric conductivity.

It is known that certain metals, when alloyed, undergo a molecular change, and that an allotropic condition may in some cases be induced by alloying a metal with a small quantity of another, facts which well deserve minute examination as bearing on the non-elementary character of certain metals, which is now receiving so much attention.

Mr. Roberts then referred to the question of applying the induction-balance to the assay of metals. In the case of gold-silver alloys the instrument will show the presence of less than two grains of gold in the pound of silver. On the other hand, the silver-copper alloys used for coinage are situated at the flat portion of the curve, so that it is impossible to detect even considerable differences in their composition, and these alloys which are very peculiar to their nature, appear to be greatly affected by annealing. More hopeful results were obtained with the gold-copper alloys, and Mr. Roberts demonstrated a difference of 1 per cent. in the standard of two gold disks, which, though far short of the existing method of assay in delicacy, appeared to afford grounds for the belief that very accurate results will ultimately be obtained.

Notes on Petroleum Spirit or Benzoline, by A. H. Allen.—The application of the commercial names "benzoline" and "benzine" to the more volatile portion of petroleum has led to great confusion between petroleum spirit and coal-tar naphtha, the most characteristic constituent of which is the hydrocarbon *benzene* or *benzol*. In this paper the author mentions several tests for distinguishing between the two bodies, the most important of which are the following:—

Petroleum Spirit, "*Benzoline* or *Benzine*," warmed with four measures of nitric acid of 1.45 sp. gravity the acid is coloured brown, but the spirit is little acted on, and forms an upper layer.

Coal-Tar Naphtha or "*Benzol*" is completely miscible with four measures of nitric acid of 1.45 sp. gravity, with great rise of temperature and production of dark brown colour.

These tests are capable of yielding quantitative results if the treatment with nitric acid be conducted in a small flask and an inverted condenser attached, to prevent loss of vapours. When action has nearly ceased, if the liquid be poured into a narrow graduated tube, the measure of the upper layer indicates with approximate accuracy the amount of petroleum spirit present. If the proportion of benzene is considerable, the nitrobenzene produced may not remain completely dissolved in the nitric acid, in which case it rises and forms a layer of a dark brown colour below the stratum of petroleum spirit. Nitrobenzene and petroleum spirit are readily miscible in the absence of nitric acid, but agitation with strong nitric acid dissolves out the nitrobenzene, a portion of which may rise and form an intermediate layer as above described.

By fractional distillation, the author found that the proportion of *heptane*, C_7H_{16} , present in commercial benzoline probably equalled, or even exceeded, that of all the other constituents.

On some Curious Concretion Balls derived from a Colliery Mineral Water, by Thomas Andrews, F.C.S.—The water on which these observations were made was collected from the "sump" of the Wortley Silkstone Colliery, a small pit situated near the "Bassett" or "outcrop" of the great Silkstone seam of coal, the samples being obtained during typical *dry* and *rainy* seasons. The water had percolated from the surface a distance of thirty-five yards, through strata, as indicated on the accompanying table.

The bottom layer in which the water lodged was the Silkstone seam of coal, here some five feet in thickness.

One noticeable feature of this water is that it always gives an acid reaction with blue litmus paper.

Several analyses of this water made at various times indicate

that the chief mineral constituents of the water are, iron—calcium, magnesium, in the form of sulphates.

This water when heated quickly throws down a copious ochreous deposit. The deposit found in the engine boilers, after having used the water in them for steam purposes was of the composition given below.

The boiler residue from which this sample was taken consisted of an incrustation about *one inch* thick, which had adhered to the bottom of the boiler.

The incrustation was of a light reddish yellow colour in the bulk, it was very hard and tough, and not easily broken in pieces.

The iron work in connection with this colliery engine and boilers, in any way exposed to the action of either the acid water itself or the steam generated from it, becomes corroded and partially dissolved. The most effectual remedy against this corrosive action and deposit is that described in my letter to the *Chemical News*, June 15, 1877.

Some curious balls of mineral matter are occasionally found in the feed tank of the colliery boilers, which are supplied with this water. The water is pumped up from the engine pond into a cylindrical feed tank, and is there heated by the exhaust steam from the engine playing on its surface (not blowing through it). The water in this feed tank has an average temperature of 164° F.

It sometimes happens that during the short space of even two or three weeks, great numbers of these balls are formed, varying in size from about three and a half inches in diameter to five-eighths of an inch diameter, and in weight from about one and a half pound to a quarter of an ounce.

The author has many of these in his possession. They are perfectly hard and compact when taken from the tank, and are, no doubt, formed from the deposit thrown down when the mineral water is heated.

The action of steam playing on the surface of the water probably causes circular eddies, and when a nucleus has thus once been formed, it is easy to conceive of the gradual formation and consolidation of these balls.

The author suggests that the conditions of formation of natural nodules of iron ore, pyrolusite, &c., may be similar to those observed by him in the foregoing cases.

On the Detection of Milk Adulteration, by William H. Watson, F.C.S., &c.—From analyses of milk from various dairies, and by a comparison of the results obtained with circumstances existing as to the character and quantity of the food; nature of different cows; conditions and health of them at particular periods; and changes of the seasons of the year, the author concludes that cows' milk is subject to considerable variations in composition. He has found, in many instances, milk from well-fed healthy cows to contain as little as 10.5 per cent. of total solids, and from 8.5 to 9 per cent. of solids not fat. The results of other experimenters are compared, and it is then suggested that the present limits adopted by public analysts for genuine milk should be reconsidered.

SECTION C—GEOLOGY

On the Volcanic Products of the Deep Sea of the Central Pacific, with Reference to the "Challenger" Expedition, by the Abbé A. Renard and J. Murray.—The mineralogical and petrological researches on the sea-bottom of the Pacific area, extending from the Sandwich Islands to 30° S. lat., and having the Low Archipelago on its approximate centre, show that volcanic matter plays an important part there. It is present in the form of lapilli and of ashes spread in great abundance in the "red clay." These lapilli nearly all belong to the basaltic type, passing from the felspathic basalts to allied rocks, in which the vitreous base assumes greater and greater development, until it almost completely displaces the crystalline constituents of basalt. The fragments then become mere glassy rocks of the basic series, in which generally are still found crystals of peridot and numberless crystallites, which are sometimes grouped in opaque granules, or arranged regularly around the microliths of peridot. The forms of these volcanic fragments, which are often coated with manganese, their association with volcanic ash, and their lithological constitution, show them not to be derived from submarine flows of lava. They must rather be regarded as incoherent products, or lapilli, the accumulations of which in the Pacific form a series of submarine tuffs. One of the most remarkable facts elicited by the soundings in the Pacific is the large share

taken in these sedimentary deposits by palagonites, quite identical in lithological characters with those of Sicily, Iceland, and the Galapagos Islands. One may, in fact, call them glasses of the basic series, playing the most important part among the sediments of the Pacific, and consisting either of sideromelane or decomposed into a red resinoid substance. The small lapilli of two or three inches in diameter are cemented by zeolites, the crystalline forms of which are those of christianite. It is enough to indicate the presence of the easily alterable basic glasses, in order to show the source of the clayey matter with which they are associated, since it is known that wherever rocks of this type occur, there also decomposition into clay is observable.

Amongst the minerals present in the volcanic ash are rhombic tabular crystals of plagioclase, augite, magnetite, with a little sanidine or hornblende. It is also remarkable to notice that in these deep-sea deposits quartz grains are practically absent, in striking contrast to the coast-deposits. It is not, however, this fact which is most worthy of note, since it is not so unexpected as the formations of zeolites in the free state. The latter phenomenon takes place in the zone in question where minute fibrous radiated spherules are formed in the mud, possessing the crystallographic characters of christianite. Besides these zeolitic globules, there are other crystals of the same kind in the form of very minute prisms, occurring in such prodigious numbers that they make up about a third of the red clay. Crystallographically these microliths must be referred to those forming the zeolitic spherules. The authors regard them as belonging to one species. The formation of these zeolites and of the red clay in which they are developed, is easily understood if we bear in mind the lithological nature of the above-described basic tuffs and of their products of decomposition.

The Geological Age of the Rocks of West Cornwall, by J. H. Collins, F.G.S.—Mr. Collins endeavours to show that a large area of West Cornwall, hitherto mapped as Devonian, really consists of upper Silurian rocks; lower Silurian rocks underlie them, whilst a still older series occurs at several points on the coast—possibly the mica schists of the Lizard belong to this oldest series.

Geological Facts observed in Natal and the Border Countries, by Rev. G. Blencowe.—Mr. Blencowe describes the country near the border of Zululand. The rocks are sandstone, capped by trap, which often stands out in isolated hills rising 2,000 feet above the plain. Evidences of ancient volcanic action are noticed.

On "Culm" and "Kulm," by Prof. G. A. Lebour, M.A., F.G.S.—He suggests that the English word "culm" be retained as a local term for the culm measures of Devon and Somerset. Under the Germanised form of the name ("kulm") are now grouped a vast mass of carboniferous slaty beds which strike across Europe from Eastern Silesia to the westernmost point of Portugal; these beds represent, not the coal measures of England, but the carboniferous limestone and underlying beds.

On some Remarkable Pebbles in the Boulder Clay of Cheshire and Lancashire, by Dr. C. Ricketts.—The pebbles give evidence of having formed parts of moraines on land. As they occur at different horizons it is inferred that there must frequently have been an advance and retreat of glaciers, moraines being formed during the retreat of the glacier, which were carried forward into the sea when the glacier advanced.

Notice of the Occurrence of a Fish Allied to the Coccosteus in a Bed of Devonian Limestone near Chudleigh, by J. E. Lee, F.G.S.—This occurs (in the upper or middle Devonian) with clymenia, goniatites, and crinoidal remains, and therefore cannot here be a freshwater fish.

Evidence of the Existence of Palæolithic Man during the Glacial Period in East Anglia, by Sydney B. J. Skertchly, F.G.S., H.M. Geological Survey.—The object of this paper is chiefly to record the sections in which the author has discovered palæolithic implements beneath the chalky boulder clay in East Anglia.

The beds which yield the implements are a series of loams, clays, and sands, to which the author has given the name of Brandon Beds. They occur at the top of the middle glacial series of Messrs. S. V. Wood, jun., and F. W. Harmer, and underlie the chalky boulder clay or upper glacial of the above-named authors.

On Carboniferous Polyzoa and Palæocoryne, by G. R. Vine.—In this paper the author drew attention to the inadequate study that had been given to the carboniferous Polyzoa. During the last few years vast masses of shales, containing Polyzoa and

other remains have been brought to light, but none that he was acquainted with excelled in richness the Hairmyres *débris*. Here the specimens were well preserved and the characters of the several species were almost perfect.

The author considered that it was too early yet to draw up a classification that would be satisfactory to all naturalists. Attempts had been made to do this, but many details had to be furnished that could only be furnished after close study. Besides the *Fenestella*, other genera were alluded to in the paper, such as *Cenopora*, *Rhabdomeson*, *Hyphasmopora*, *Glauconome*, and *Diastopora*; but these are being studied analytically, and further details of their structure will be brought forward in a future report.

Palæocoryne was next alluded to, and the author said that he had identified all the species and forms of Palæocoryne that had been figured by Dr. Duncan in his various papers; but the conclusion the author had arrived at was—that these so-called organisms were neither hydroid, as was supposed by Dr. Duncan, nor foraminiferal, as was suggested by Dr. Allman. All the forms were referable to species of *Fenestella* and *Polyzoa*. Although this opinion was given with some confidence the author was not prepared to say at present that the whole of Dr. Duncan's views were illusive. There can be no doubt but that the forms *P. scotica* were really infertile processes; but *P. radiata* had presented so many peculiar details to the author, that until he had satisfied himself as to the nature and purpose of this structure in the polyzoary of the Polyzoa, he was not prepared to substantiate that Dr. Duncan had given an erroneous judgment, although *P. radiata* may turn out to be after all a portion of *Fenestella* and not a parasite.

On the Replacement of Siliceous Skeletons by Carbonate of Lime, by W. J. Sollas, M.A., F.G.S., &c.—The author gave an account of certain calcareous fossil remains which exhibit, both in gross and minute structure, a close resemblance to certain existing siliceous sponges, and which differ widely from any known form of calcareous sponge. The natural inference appeared to be that the calcareous fossils were once siliceous sponges, the siliceous parts of which had undergone replacement by carbonate of lime. The alternative view that the fossils were originally calcareous, and that they represent an extinct group of Calciopongia, was discussed and shown to present far greater difficulties to the zoologist than the inferred mineral replacement offered to the chemist. Siliceous sponge spicules were stated to be remarkably soluble, yielding readily to the attacks of minute boring algae, and undergoing solution in sea-water soon after the death of the sponge which possessed them.

The radiolaria of the carboniferous limestone were likewise regarded as having once possessed a siliceous composition, which they had since exchanged for a calcareous one.

On the Foundations of the Town Hall, Paisley, by M. Blair.—Dolerite underlies the boulder-clay there, and is probably the source of boulders of a similar rock which occur in the drift, and which have hitherto been considered as strangers to the neighbourhood.

On "Ostracocanthus dilatatus" (gen. et sp. nov.), a Fossil Fish from the Coal-Measures South-east of Halifax, in Yorkshire, by J. W. Davis, F.G.S.—This is an ichthyodolomite nearly 1½ inches long, and ¾ inch broad at the base. From the base the diameter diminishes rapidly, and at half an inch from the apex it is only ⅓ of an inch. It remains of this size to the apex, and ends in a blunt point. The upper part is smooth, with hard ganoid covering. The lower part is longitudinally furrowed, increasing by bifurcation towards the basal end. At first sight it somewhat resembles the *Byssacanthus* of Agassiz, and also the spine of *Ostracion cornutus*, but the similarity disappears on closer examination. From the spine and its mode of attachment it is probably a representative of the Teleosteans during the coal period.

SECTION D—BIOLOGY

Department of Zoology and Botany

On the Capreolus or Spermatophore of some of the Indian Species of the Helicidae, by Lt.-Col. H. H. Godwin-Austen, F.Z.S., &c.—The author points out the importance of the examination of the animal in many genera of the Helicidae, and thus to obtain better characters for specific distinction than are often presented by the shell alone. The organ first discovered and described by Lister in 1694 is treated of, and the views of later naturalists al-

luded to. Many different forms of the spermatophore found in Helices from Eastern Asia, are shown and the position of the organ in the generative system of *Helicaria magnifica* from Burmah is described.

On Budding in the Syllidean Annelids, chiefly with Reference to a Branched Form from the "Challenger," by Dr. W. C. McIntosh, F.R.S.—Propagation by budding is a prevalent feature amongst the Cœlenterata, the organisms assuming in many cases a dendritic appearance, so that the name of sea-trees given to them by our fishermen is by no means inappropriate to their external contour. A similar condition is seen in many of the Polyzoa, and in the creeping stolons of *Clavelina* and *Perophora*. In the sub-kingdom Vermes, again, naturalists have been long familiar with a mode of propagation by division or fissiparous development. Thus O. F. Müller describes two kinds of budding in the fresh-water *Nais proboscidea*, and gives an account of the same process in *Nereis prolifera*. Amongst others, De Quatrefages and Frey and Leuckart in the same species; Milne-Edwards in *Myriandra*; Sars in *Filigrana*; O. Schmidt in *Nais microstoma* and *Filigrana*; Max Schultz, R. Leuckart, and Traube in the former species; Alex. Agassiz in *Autolytus cornutus*; Schmarda in *Catenula*; and Lankester in *Chatogasta*, show how widely this mode of development has been recognised. The feature that mainly concerns us at present in regard to these descriptions is the fact that a new animal is produced in a line with the old by various modifications of budding. In no instance is there any approach to a branched condition by lateral offshoots from either parent stock or bud. As an example of one of the best known marine forms, the account of *Autolytus cornutus* by Alexander Agassiz may be cited. This species exhibits a kind of alternation of generation, the parent stock (which is a sexual) giving rise posteriorly to male and female buds which differ much in appearance from each other. The latter produce ova, which by and by develop in the peculiar body-sac into a swarm of parent stocks with which the cycle commenced.

The discovery of a species (*Syllis ramosa*) of the same family (*Syllidae*), which forms an intricate series of branches by lateral budding of the parent stock, by Sir Wyville Thomson in a hexactinellid sponge from Zebu, is one of the remarkable results of the Challenger expedition.

A detailed account of the animal then followed, and the remarkable absence of all trace of a head prominently noticed.

Embryology of *Gymnadenia conopsea*, by F. Marshall Ward. —The researches of the last two years, especially of Strasburger¹ and Warming,² and also of Vesque,³ have yielded results sufficiently at variance with the older ones to warrant a serious reconsideration of the whole question of homologies. The main points may be put somewhat as follows:—

The embryo-sac is not the result of simple enlargement of one cell; a cell of an axial series of the ovule enlarges and cuts off two or more cells from its apex—the remainder becomes the embryo-sac,⁴ and causes dissolution of the others as it enlarges, their remains persisting as refractive caps for some time. The protoplasmic contents of the embryo-sac separates into two chief masses, which pass to the opposite ends of the enlarging sac, a large vacuole forming between. Each mass then suffers division into four by planes cutting one another at right angles. In this way eight nucleated masses of protoplasm without cell-walls arise, three of which remain at each end of the embryo-sac, while one from each end wanders towards the centre of the sac and there fuses with its neighbour to form the nucleus of the sac.

Of the three anterior nucleated masses, two become elongated, fit into the top of the embryo-sac as the "Gehülfinnen," or "synergidae" of Strasburger, and are probably what Schacht described as the "filiform apparatus"; their function is somewhat obscure, but appears to be related to the act of fertilisation between the end of the pollen-tube and the third nucleated mass, which has rounded off as a large bright egg-cell or ovum, and is suspended from the base and sides of the "Gehülfinnen."

The three posterior masses may not become completely isolated, or they may remain passive, or some may disappear, or they may multiply by division. Where endosperm is formed they appear to enter into its formation.

The author finds in *Gymnadenia*,⁵ *Butomus*, *Alisma*, *Anthericum*, and *Ranunculus* ovules, confirmation of these views.

¹ "Ueber Befruchtung u. Zelltheilung," and "Die Angiospermen u. Gymnospermen."

² *Ann. des Sc. Nat. Bot.*, 1878.

³ *Ann. des Sc. Nat. Bot.*, 1878.

⁴ Vesque, however, thought a fusion of at least two superposed cells produced the embryo-sac.

⁵ Strasburger has partly worked this, so far as the first divisions of the

embryo-sac mother-cell are concerned. He also gives figures of Anthericum. Vesque's account of *Butomus* is not supported by the author's drawings.

Comparison of the Effects of the Frosts of 1860-61, and of 1878-9, by E. J. Lowe, F.R.S.—The greatest cold of 1860 exceeded that of last winter by 10°; it was 6° below zero in 1860, and 4° above zero in the late frost.

The present paper records the great difference in the effects in the two frosts at Highfield House, Nottingham:—

Name.	Frost of 1860.	Frost of 1878.
Acacia (long spined) . . .	Slightly injured . . .	Many boughs killed and was a month later coming into leaf.
Elm (broad leaved) . . .	Uninjured	Three-quarters of boughs killed back at least 2 feet.
Bay (sweet)	Killed to the ground . . .	The ends of the shoots only killed and all the leaves.
Deodar cedar	Became deciduous, otherwise uninjured . . .	Not injured.
Arbutus	Killed to the ground . . .	Half the branches killed, the others injured.
Aucuba	"	Uninjured.
Pampas grass	Killed	Killed.
<i>Araticaria imbricata</i> . . .	Killed to where buried in the snow . . .	Uninjured.
Yew	Slightly damaged . . .	Slightly damaged.
<i>Wellingtonia gigantea</i> . .	Much injured	" "
Evergreen oak	Many killed, all became deciduous	Uninjured.
Ivy	More or less injured . . .	More or less injured.
Fennel	Uninjured	All killed.
Sage	Killed	Uninjured.
Roses (standards)	All killed	Many killed, nearly all injured.
" on their own roots . . .	Many killed	Uninjured.
<i>Retinospora obtusa</i> . . .	Killed	"
" <i>squamosa</i>	"	Slightly injured.
" <i>leptoclada</i>	"	Uninjured.
" <i>ericoides</i>	"	"
" <i>filifera</i>	"	"
" <i>plumosa</i>	"	"
" <i>plumosa argentea</i> . . .	"	Slightly injured.
<i>Juniperus excelsa</i>	Killed on the north half of the tree	Uninjured.
" <i>chinensis aurea</i> . . .	"	"
<i>Phoridium tenax</i>	Killed	Only killed to the ground.
<i>Ergenia ugni</i>	"	Half the branches killed.
<i>Yucca gloriosa</i>	"	Slightly injured.
<i>Cineraria maritima</i> . . .	"	Killed.
Laurel, common	Many killed to the ground	Uninjured.
" Portugal	Nearly all killed . . .	"
Holly	Most killed in the branches to the height of 7 feet	"
<i>Thuja aurea</i>	Mostly killed	Slightly injured.
Cork tree	Killed	"
<i>Deutzia gracilis</i>	Scarcely injured . . .	Uninjured.
Quince	Killed	"
Yew, golden	Slightly injured . . .	Uninjured.
<i>Pinus insignis</i>	Killed	"
" <i>pygmy</i>	Slightly	"
" <i>menziesii</i>	Became deciduous, and had no leaves for a year	"
" <i>morinda</i>	Slightly injured . . .	"
Laurustinus	All killed	"
<i>Abies Nordmanniana</i> . . .	Uninjured	Lost half its leaves and some boughs.
Walnut	Boughs killed and one tree	Uninjured, except a want of vigour; leaves only half the usual size.
Apples	"	Leaves small, fruit scarce and remarkably small.

embryo-sac mother-cell are concerned. He also gives figures of Anthericum. Vesque's account of *Butomus* is not supported by the author's drawings.

¹ *Ann. d. Sciences Nat.*, 1878.

² *Ann. d. Sc. Nat.*, 1878.

The above will sufficiently illustrate the effects of the frosts in two severe winters.

It is worthy of remark that instead of cold killing the slugs and various pests of plants, they were never known so numerous. Many hardy plants in pots were killed, such as ivy, *Pteris aquilina*, &c., when they escaped if plunged in the ground.

Recent Additions to the Moss Flora of the West Riding of Yorkshire, by Charles P. Hobkirk, F.L.S.—After treating of the work of the Yorkshire Naturalists' Union, in investigating the fauna and flora of the country, the author particularised some of the chief species found since 1873, and gave the history of them, viz., *Seligeria tristicha* at Littondale; *Aulacomnium turgidum* at Whernside; *Fontinalis gracilis* at Malham Cove; *Plagiothecium nitidulum* at Penyghent, &c. Four lists were appended to the paper, viz.: (1) New species, 48; (2) Species found in fresh localities, 142; (3) Localities previously known, but not recorded, 29; and (4) Species inserted in error in previous list, 8; making the total number of species now recorded for the Riding, 327.

Department of Anthropology

Flint Implements from the Valley of the Bann, by W. J. Knowles.—I have obtained within the last three or four years, from the banks of the River Bann, a series of flint weapons or tools which differ considerably in type from the ordinary flint implements of the North of Ireland. They have been obtained from a deposit of diatomaceous earth used for brickmaking, near the town of Portlengone, and are of two types. That which is most numerous appears to have been made by splitting up nodules into halves and quarters, and then forming these into rude pointed implements by a process of coarse chipping. This kind numbers upwards of fifty, and they all agree in having a cutting point and thick base for holding in the hand. They are as a rule long, narrow, and of a cylindrical form rather than broad and flat, but some of the latter kind occur. Some of the largest are 7 or 8 inches long and from 2 to 3 inches broad at the base, and there is one fine implement of the flat kind, very like the triangular palæolithic implements, which is 6 inches long, nearly 4 inches broad at the base, and $1\frac{1}{2}$ inches thick. Dr. Evans, in "Stone Implements and Ornaments of Great Britain," mentions that he has found implements of palæolithic form on the shores of Lough Neagh, near Toome, and I have also found them there myself, but as Toome is only a little farther up the Bann, and the diatomaceous earth is found there, I believe they have been derived from that deposit by denudation.

The second set of objects may be described as large triangular flakes with a central rib down the back, and having the base wrought into a tang. In the Catalogue of the Royal Irish Academy this form of implement is represented in Fig. 3, the tang being looked on as the first step of development into arrow- and spear-heads; but I am of opinion that instead of showing a step towards greater perfection, these were perfect implements of their kind, and also manufactured specially for use about rivers.

There is no means of determining the age of these objects except we form some sort of estimate from the fact of their being found in a deposit underlying peat. If they are of neolithic age they are very interesting from being confined chiefly to a river valley, and not being obtained where other neolithic implements are found in abundance. This fact would, I think, suggest a reason for the large triangular flints of palæolithic age being chiefly confined to the old river gravels, while the implements of the same age from the caves are so different. The implements of the pointed kind in all cases might not be for general use, but chiefly for the river valleys. They may probably have formed weapons for attacking the larger animals when they came down to drink, but the theory that they were used for breaking holes in ice I think a very likely one. I believe the tanged flakes were used mounted probably for spearing fish, as suggested by Dr. Evans in "Archæologia," vol. xli. p. 401.

On the Relations of the Indo-Chinese and Inter-Oceanic Races and Languages, by A. H. Keane, M.A.I.—The conclusion arrived at by the author, is that, excluding the dark races, there are in the Indo-Chinese and Inter-Oceanic area two fundamentally distinct racial types only—the yellow or Mongolian, and the fair or Caucasian; and corresponding to them two fundamentally distinct forms of speech only—the monosyllabic spoken *vario tono*, and the polysyllabic spoken *recto*

tono. All the rest is the outcome of incessant secular interminglings.

Mr. Sydney B. J. Skertchly, F.G.S., H.M. Geological Survey, read a paper *On the Evidence of the Existence of the Palæolithic Man during the Glacial Period in East Anglia*. The object of the paper was chiefly to record the sections in which the author had discovered palæolithic implements beneath the chalky boulder clay in East Anglia. He said:—"The beds which yield the implements are a series of loams, clays, and sands, to which the author has given the name of Brandon Beds. They occur at the top of the middle glacial series of Messrs. S. V. Wood, jun., and F. W. Harmer, and underlie the chalky boulder clay or upper glacial of the above-named authors. They have yielded palæolithic instruments in many places, but only those will be described in which the chalky boulder clay overlies the Brandon Beds at the present time. Near Mildenhall, on the River Lark, in Suffolk, two sections have yielded implements. They are at Warren Hill and Mildenhall Brickyard. The section at Warren Hill is as follows:—1. Sandy soil, &c., two feet. 2. Chalky boulder clay six feet. 3. Gravel four feet. 4. Loamy clay four feet. 5. Boulder clay six feet. 6. Chalk. This spot has yielded great numbers of flakes and many implements. It was originally described by Professor Prestwich, but the boulder clay has only recently been exposed above the tool-bearing loams. At Mildenhall Brickyard the section is—1. Sandy soil one foot. 2. Chalky boulder clay six feet. 3. Loam ten feet. 4. Chalk. From this place many implements and flakes have been obtained. They occur in the loam, Culford in Suffolk: The Brandon beds are here dug under fifteen feet of solid boulder clay; from these I obtained two flakes. West Stow, in Suffolk: Boulder clay overlies, underlies, and wraps round the Brandon beds at this place; some well-worked implements have been obtained, one of which was dug out by the author. Brandon: Near Brandon the same beds are being dug beneath boulder clay, and have yielded very good implements. The peculiarities of the implements are pointed out, and the mode of distinguishing them from specimens from the gravels is indicated. The author in this paper merely desires to emphasize the fact that from several sections he has himself dug out palæolithic implements from below tough, undisturbed chalky boulder clay. These proved the existence of man in these districts previous to the glacial periods.

The Chairman said that if Mr. Skertchly's facts were sound and his inferences well warranted it was obvious to all the matter was one of the greatest importance. He invited discussion.

After some remarks from Dr. John Evans, Prof. W. Boyd Dawkins (Manchester) said there was no evidence that the glacial period was to be looked on as a dividing line in classification. He fancied that all the animals that were living after that period of extreme cold had passed away appeared in Europe before that cold was felt, and he could not therefore, look on the glacial period as a hard and fast line. It seemed to him if they applied that consideration to the examination of the question of the antiquity of man there was no *à priori* reason for supposing that man was not here in the pre-glacial age. Seeing that animals were living in Europe before the cold period arrived at its maximum, it was probable that man was here too. Man was living in the south of this country when the area north of the Thames was submerged—when the sea there was bearing icebergs which were accumulating the boulder clay.

Sir John Lubbock, said that as geologists they must be careful before they came to any definite conclusions on a matter of this importance. He confessed that after listening to the paper which they had just heard he felt considerable difficulty in resisting the conclusions which Mr. Skertchly had drawn from the facts. He thought there could be no doubt that the implements before them were the work of man.

Professor Huxley said that without the slightest desire to discourage the excellent efforts Mr. Skertchly had made, he confessed he could not attach any great importance as to whether those particular deposits were post-glacial, inter-glacial, pre-glacial, or how. There was not the slightest doubt that at the end of what was commonly recognised as the tertiary period there was a time in which the climate of this country became extremely severe—there was a great formation of ice. There was no doubt that the animals which existed in this part of the world immediately before that deposit, were practically the same as those just after. If they looked at the glacial epoch as a period

of duration of animal life—the period it occupied was totally insignificant in regard to that which they would require for the evolution of man to his present state. There could not be the slightest reason for supposing that pre-glacial man was in any way different from post-glacial man. No doubt, whatever habits of life were adopted during the cold period, were adopted before that cold fairly set in. As the people lived like Equimaux during the whole of the cold period, and for some time afterwards, he could not see why they should not have lived in that fashion for some time before. There could not be a doubt in any reasonable man's mind, that the remains of man discovered in the older part of the glacial deposit were the same as those in the new. The evidence Mr. Skertchly had brought forward was very satisfactory, but he confessed he did not see why it should not be so.

Mr. Skertchly read a paper *On a New Estimate of the Date of the Neolithic Age*.—The Fenland occupies an area of 1,300 square miles around the great bay of the Wash. The surface of the inland portions consists of peat, and that of the seaward parts of marine silt. This silt is still in process of deposition, and the land is consequently gaining upon the sea. From the time of the Roman occupation, at least, banks have been successively erected to reclaim the newly-formed ground; and as the dates of these banks are known, very accurate estimates can be formed of the rate at which the deposition is going on in different parts. The maximum rate is fifty-nine feet per annum, and four miles of new land has been formed since the oldest banks were erected. These banks are generally ascribed to the Romans; but they are probably British. In this estimate they will be taken as Roman, in order that the age may not be over estimated, and the maximum rate of deposition will also be used as giving the minimum of time. The geological evidence shows that as the silting went on, and the area become converted into land, peat grew and gradually spread over the newly-formed ground. But in process of time the climate became unfitted for the growth of peat, which gradually lost its vigour, and finally ceased to form. Hence a wide stretch of silt land borders the Wash, upon the surface of which no peat has ever formed. The peat died upon its eastward march; the silt still travels on. The nearest approach of the peat to the banks along the line of most rapid accumulation is twelve miles distant therefrom. The age of this, the newest peat in the Fenland, can be thus determined. Between the "Roman" banks and the sea lie four miles of silt, which has taken 1,700 years to accumulate. Between these banks and the sea lie twelve miles of silt, which at the same rate of formation would take 5,100 years to accumulate. Adding 5,100 to 1,700 years, we have 6,800 years as the least possible age of the newest peat. This peat has yielded many neolithic implements, hence we may assume that 7,000 years will take us back into the neolithic age. The coincidence of this estimate with the two Swiss ones above-mentioned is remarkable. These results do not, however, give us the date of the introduction of the neoliths into Europe, for neither in the Swiss nor English localities are we sure that the neolithic relics belong to the early part of the neolithic age. The author, indeed, has recently obtained evidence of neolithic handiwork in Fenland peat of far greater age than that described, the peat bed underlying silt more than 7,000 years old. He is inclined to think that the neolithic age in England began at least 10,000 years ago, and perhaps 20,000 years; but that it does not approach the close of the glacial epoch seems to be shown by the fact that the older Fenland beds (themselves post-glacial) do not contain human relics.

Commander Cameron read an interesting paper giving a detailed account of the *Manners and Customs of the People of Urua, one of the largest Native States in Central Africa*. This particular race maintained many places in which religion was centralised. Kasango, the king or principal chief, was not merely a secular chief, but was also intimately mixed up with the religion of the people. He claimed divine praise, and at his death was buried with savage rites, and all his wives except one were slaughtered at his grave. This one remained to be the pythoress of his successor, and the spirit of the chief at his death was supposed to be transmigrated into the body of his successor. An idol was preserved in the middle of a dense jungle. He had for a wife one of the sisters of the reigning sovereign. Around about the jungle were the huts of a numerous class of priests, who received the tribute collected for that class of people. The only person allowed to sacrifice to the idol or to visit him except the idol's wife was the sovereign

of the country. There was a numerous class of wizards who carried about with them small idols and a large stock-in-trade in charms, which they sold. Many of them were ventriloquists, and it often happened when they were consulted by the natives questions were asked which were communicated to the idol, and then the wizard, by the exercise of very poor ventriloquism, made the idol return an answer to the question put. The caste was very clearly defined in this race. The chief allowed none of his subjects to sit down in his presence without permission, and he seldom accorded it. No one of a lower grade could sit down in the presence of one of a superior grade. The customs in eating, drinking, and cooking were various. They declined to eat in the presence of each other, and, although fond of the native beer, they would not drink it while anybody was looking on, although it was sufficient to hold up a cloth as a screen. All the different castes and ranks were marked and distinguished by their dress. The attire was very simple, consisting usually of an apron. They were not a hairy race, but managed to grow their beards very long, and they plaited them after the manner of a Chinese pig-tail, winding up with a ball of dirt at the end to make it hang down straight. The women were tattooed most extensively. The means of communicating news was by drums and messengers. The men could run very fast. One man, for instance, brought him a message from the king, having come a distance of between 50 and 60 miles in a period of six hours. By means of certain beats on the drum messages could be sent immense distances, and answers immediately returned. In time of war the king could send messages to a great distance, either to bring up his forces at once, or to say that he was returning and that they were to go back.

Major Serpa Pinto read a paper *On the Native Races of the Head Waters of the Zambesi*.—He said they there found people whose complexion, as compared with his, then bronzed with an African sun, was white, yet they were negro in feature. There were also mixed races in that part of the country, with complexions of a whitish cast, yet with negroid features. The whole matter seemed to indicate in a most puzzling way the mixture of races. In the Bihé district, that portion of the population had, for the most part, made its appearance during the last century. It was not a pure African, but probably a mixture with the races which came over for elephant hunting purposes. The pure African type, of course, was the flat nose, large lips, and frizzled hair; but there had been some modifications in this instance with regard to feature. He declared that he had seen girls in that part of the country who, if their complexions had been more like that of the Europeans, would have passed for beauties here.

M. Brazza read a communication *On the Native Races of the Gaboon and the Ogové*.—Major Pinto, he said, had spoken of races having European characteristics. He was of opinion that those people had come from the North of Africa, because under the name of Ubamba he had found races very much resembling them to the south of the Congo. The negroes Major Serpa Pinto saw were probably the advanced guard of an invasion which had overrun the country to the east of the Gaboon. Stanley spoke of a great emigration, very much resembling what had taken place among the Fan cannibals. There had been much talk indulged in adverse to the cannibal races of this part of Africa. Du Chaillu, who had visited for one day only one of the Fan villages, had given a description of this race which had been too much influenced by accounts he had received from a tribe at war with the cannibals. He had said that in their villages he had found quarters of human flesh exposed for sale; that they killed and ate their prisoners of war, and that they sold the bodies of their own dead who had died of disease to their neighbours. M. de Brazza denied the truth of such accounts. As a proof that the Fans had kindly and generous sentiments he told how a Fan chief had been kind to him when he was obliged to leave his people sick in the bush. He owed his life to the Fan chief, and he should always be grateful to him and his people. He wished therefore to do all he could to remove the prejudice against the Fans which had been excited by Du Chaillu. They were a very generous, courageous people. It was true they were cannibals—that they ate their prisoners of war; but it was with them a religious idea, for they believed that in eating the heart of a brave man the courage of the dead passed into themselves. M. de Brazza also gave an interesting sketch of the Akkas, a dwarf race he found scattered up and down among the different peoples, like what the Jews or the gipsies were in Europe. The height of the Akkas was from three to four feet.

Mr. V. Ball, M.A., of the Geological Survey of India, in continuation of some remarks made on this subject at the last meeting of the Association in Dublin, gave an account of the results at which he had since arrived from an examination of all the available data. These were that the three classes into which the stone implements might be grouped occupied independent geographical tracts which overlapped one another towards the centre of the peninsula. The geographical tracts characterised by the prevalence of one or other of the particular forms when laid down on a map showed a remarkable coincidence with the limits of the areas of distribution of the non-Aryan races belonging to the several families whose waves of immigration had contributed to form the lower strata of the population. Thus the manufacturers of the polished Celts were identified with the Kolarian races who entered India from the north-east and Burmah. On the other hand, the manufacturers of the flakes and cores of flint, &c., appeared to have entered the peninsula from the north-west, and to have belonged to the Dravidian family. The identity of the manufacturers of the chipped quartzite implements which were found in Southern India, was less clear, but suggestions regarding it were also offered by the author.

SECTION E—GEOGRAPHY

Mr. C. E. D. Black, read a paper *On the Geography of the Upper Course of the Brahmaputra*.—With especial reference to a recent important exploration of the easternmost portion of its course, made by one of the native explorers attached to the Indian Survey Department of this piece of work, though executed in 1877, no description had reached Europe, and its communication for the first time to the British Association was therefore a geographical event of very great interest. Mr. Black commenced by tracing the topography of the great Sanpée river from its source 15,000 feet above sea level in Western Tibet, over lofty plains, past the towns of Janglache, Shigatze, to the furthest eastern point to which it had been traced by the famous Indian explorer, Pundit Nain Singh, noticing *en route* the remarkable hot springs in the valley of one of the northern tributaries, the Shiang-chu, and the various rivers which join it on the left and right banks. The plain and city of Lhasa, the residence of the Dalai Lama and of the Chinese governors or agents, was described, as well as the amusing incidents accompanying the transit of the river on the occasion of that eccentric traveller, Mr. Manning, proceeding to Lhasa. From Chetang eastward commenced the new work of the explorer, N—g, who had been commissioned by General Walker, the Surveyor-General of India, to explore the course of the Sanpée for as great a distance as possible. Crossing to the north bank of the river, he followed it for a distance of 30 miles, nearly to the confluence of the Milk-chu, a small stream. Here he diverged to the north-east, making a detour of 50 miles, while the river wended its way for 20 miles through impenetrable mountains. The most remarkable feature of the exploration was the discovery that the river made a huge bend northwards before commencing its south-eastern course into Assam. This bend was actually surveyed by the explorer. From his furthest point to the highest known point of the Dihong, an unsurveyed gap of about only 100 miles now remains. Mr. Black concluded by pointing out that this great bend, which was previously unknown, now leaves room for a northern feeder of the Subansiri, and thus accounts for the large bulk of the latter river. Mr. Black also cited some important corroboration of this new fact, afforded by the Abbé Desgodins' researches, and by the recent measurement of the discharges of the large rivers of Assam by Lieut. Harman, R.E.

Prof. P. J. Veth, president of the Dutch Geographical Society, contributed a paper, giving interesting details of the *Dutch Expedition to Central Sumatra*.—The most important result of the expedition was the gain in knowledge of the great extent and capabilities of the Batang-Hari, which is found to be about 210 miles in length in a straight line, and over 490 miles following its windings, being in fact larger than the Musi or Palembang, hitherto considered the only large river in Sumatra. It is practicable for small prahus, used in transport of merchandise, for 480 miles; and the steam launch drawing $3\frac{1}{2}$ feet could navigate it for 370 miles, both these distances far exceeding the navigable portion of the Musi. Its tributaries are also navigable for boats, and one of them at least for the launch. The population of its district as a

whole is scanty, yet there are numerous villages close to each other; cattle abound in the highlands, and coffee is largely cultivated in Karinchi. The importance of the river as a highway for the eastern parts of the West Coast Government and the inland districts of Jambi and Karinchi does not therefore merely depend upon its fitness for transport of coal from the Ombilin Valley.

A paper by Major Pinto was read *On his Journey across Africa*, in which, though he did not tell much that was new of his exploration, he referred to one or two points of some scientific importance. He was desirous of calling the attention of the Section to the manner of determining the longitudes by the eclipses of the satellites of Jupiter, and he suggested a means of overcoming an obvious difficulty. Let it be resolved, he said, that in one of the many official observatories that had the support of Europe the eclipses of the satellites of Jupiter be studied without interruption, and the solitary explorer, lost, so to speak, in the enormous solitudes of the dark continent, when he in the obscurity of night saw the little brilliant speck disappear, would know that in a position perfectly determined some other person likewise at that same moment saw the small satellite disappear, and he will have the consciousness that on his return to Europe he will meet with the necessary elements to determine as many strictly correct longitudes as were the observations he might have made. When the planet was in conjunction the telescope might be turned toward the star that hid itself, or by making a series of apozonites of the moon they would obtain their longitudes. Any explorer of tropical Africa once provided with the aba and a telescope of 4 feet focal distance would find himself in a position to determine two of the co-ordinates and any variations of the compass. Major Pinto further recommended the hypsometer and aneroids for altitudes. Major Pinto gave a short *résumé* of the meteorological conditions of the Zambesi. He explained that the banks of the upper part of the river were of a fine and white sand of a remarkable character; when trod upon it produced a queer sound resembling somewhat the crying of a young child. The range of the Catongo mountains was well peopled on the westward, and it was there the Barotzes made their plantations, which consisted of maize, sweet potatoes, pumpkins, and mandisca. The great plain was not availed of for agriculture. Around the lakes and some other places a kind of grass grew, upon which thousands of oxen might be seen grazing. The Luinas followed the calling of shepherds. Horses could very easily be bred there, and the Barotzes possessed a splendid specimen of hounds, with which the natives hunted the antelope. The human race at present populating the country was a true mixture of the Lobares, Luinas, and Janguellis. The makalots had now disappeared completely. Polygamy prevailed, and, contrary to what occurred in most other tribes, women who were held to be noble enjoyed high consideration and were sometimes invested with the exercise of public functions. The Barotzes possessed a tolerable quantity of firearms, but their natural arm was the assegai. They were rather industrious and good tanners, but did not use the knife, doing all their work with the blade of the assegai.

Several important papers on Afghanistan were read in this section by officers and others who had been with the English army in the recent Afghan war.

Mr. William Simpson, the special artist of the *Illustrated London News*, read a paper, entitled *Afghan War—the Jellalabad Region*.—The tendency of his explorations, beyond his own proper sphere as an artist, was rather archaeological than geographical. No account of the Jellalabad Valley would be complete without some notice of the Buddhist remains to be found there. He was aware previously of the existence of these remains, but what astonished him was the vast quantity of them still to be seen. On all sides are extensive mounds and heaps, that being the condition in most cases of these remains. Here and there structures may be found, which, although in ruins, yet bear on them some traces of architecture. One point is apparently clear, that in the Buddhist period the population of the Jellalabad Valley must have been much more numerous than at present, and that the area of cultivation must have been also more extensive. Major Cavagnari supplied the author with a working party to make excavations at the Ahin Posh Tope, about a mile south from Jellalabad. The principal object was to explore the architectural details of the remains, but while thus engaged, the author penetrated, by means of a tunnel, cut for about 45 feet through solid masonry, to the central shell of the shrine, and found along with what were most probably the ashes of some Buddhist saint of high repute, twenty gold coins,

each about the size of a sovereign. Seventeen of these were Bactrian, or Indo-Scythian; and three were Roman.

Major Campbell described the *Shorawak Valley and the Toba Plateau in Afghanistan*.—The Shorawak valley had never been visited by Europeans before the recent campaign. It is a narrow strip of flat country lying between the desert on the west and north-west, and a range generally known as the Sarlat Hills to the east. Its total length is about 40 miles, with a width of 10 miles at the northern end; and it is 3,250 feet above the sea. The head of the valley, to the north, is closed in by the southern spurs of the Khwaja-Amran range of mountains, which nearly join the north-western spurs of the Sarlat Hills, only leaving a gap of about a mile through which the Lora river runs into the valley. The valley is thickly populated, and crops of wheat and barley are raised. Major Campbell suggested that Shorawak was once a lake, which was gradually silted up by deposits from the Lora, and this seems to account for most of the phenomena. The river, after flowing through the valley, is swallowed up in the sand of the desert. The Toba tableland is at the north-eastern extremity of the Khwaja-Amran range of mountains. The general elevation is over 7,000 feet. Major Campbell gave an interesting account of this plateau and of its inhabitants. It will probably form an excellent hill sanatorium for the troops stationed in the Pishin Valley. The climate of the plateau in summer is very pleasant.

Papers were also read *On New Routes to Kandahar*, by Captain Haldich; *On Surveys Around Kandahar*, by Captain M. Rogers, R.E.; and *On the Orography of the North-West Frontier of India*, by Mr. Trelawny Saunders.

Mr. Black read a paper, which had been contributed by Mr. J. O. N. James, deputy superintendent of the Surveys of India. The object of the paper was to sketch out, in a concise manner, the nature of the work in progress and already performed by the Indian Survey Department, and to point out its practical utility. During the administration of Sir Henry Thuillier, late Surveyor-General of India (1861 to 1877), an area of not less than 290,000 square miles was surveyed and mapped, including the wildest and least known tracts of India. This enormous area, more than double the size of Great Britain and Ireland, was surveyed in sixteen years at an average cost of 2*l.* per square mile. Also an area of 493,000 square miles was completed on the village survey system on a scale of four inches to the mile, and 12,281 square miles by cadastral measurement on a scale of 16 and 32 inches to the mile; making an aggregate of 505,574 square miles, considerably more than double the area of France. The revenue surveys comprise a great portion of Bengal and Assam, all Oudh, part of the North-West and Central Provinces and Bombay, nearly all the Punjab, and all Sind. There is not a single official in India who does not possess maps of the portion of the country included in his jurisdiction, which are suited to every present requirement. The maps issued by the Surveyor General's Department are also utilised by engineers in the construction of public works, by the foresters for conservancy purposes, by mining companies, planters, holders of estates, and by every branch of the civil and military services for purposes too numerous to detail.

SECTION F—ECONOMIC SCIENCE AND STATISTICS

Papers were read in this Section by Dr. Gladstone *On Elementary Natural Science in the Board Schools of London*, by Mr. Miss, of the Sheffield School Board, on a similar subject, and by Mr. Hance, of the Liverpool School Board, describing the successful efforts made by them in science teaching. In the interesting discussion which followed, Mr. F. Wilson observed that what they required was the introduction of the science of perception. A child could see a thing and not always perceive it, therefore it was most essential that they should teach scholars to perceive and so obtain a system of order.

Dr. R. Wormell remarked upon the importance of having teachers who knew something about the teaching of science in the beginning, and spoke of the necessity of a college where teachers could be instructed in order to carry on the work of scientific teaching. There were 1,600 young men entering the training colleges every year, and at least too of these would do better as teachers of science than of other subjects. Scientific education ought to find its way into all schools from the earliest stages to the most advanced. The Kindergarten system was a fair beginning, but it was too restrictive. Observation and ex-

periment were the means by which truth had to be discovered, and when science was taught simultaneously with other subjects they would find that the intelligence of the pupils was heightened, and that their skill in manipulation, and ability to use their hands, would increase, no slight point when it was remembered that the manufacturing population were educated in these schools. It would, in his opinion, help such bodies as the London School Board, who were anxious for this scientific teaching, if the British Association had a permanent committee to consider the question and give assistance if required.

The Rev. A. Harland referred to the difficulties of teaching natural science in the country school. It was not only necessary, he said, that our teachers should have a thoroughly scientific knowledge, but that the inspectors of the schools should also possess it. So little encouragement had the inspector given that he had even told them in their school to drop such subjects as botany, and to confine their attention pretty much to the three R's. He had, however, an evening with the village children, when he tried to give them some knowledge of chemistry and physiology in order to show them the evils of intemperance, and he thought this was much better than making them commit to memory silly recitations, as was the practice in some Bands of Hope.

Miss Becker (Manchester School Board), after remarking that the question of giving children scientific teaching was only valuable as to the help it would give them in making their way through the world, said she was sorry the science of mechanics was confined to the boy's school because any girl or woman who had to do household work was painfully conscious that she had frequently to move weights, and if she understood the principles of mechanical science it would be far less laborious and less painful—in fact, the principle of the lever was of the utmost consequence in domestic economy. The scrubbing of a floor, and the carrying of a coal-box were mechanical operations which were much better done on scientific principles. Animal physiology had a very close relation to the infant's organisation in its most tender stages, and in the interests of the babies she did think it most important that the common elementary principles of physiology should be known to their mothers.

After some further remarks by Miss Becker, showing the value of a knowledge of science in the commonest duties of every-day life,

Prof. Silvanus Thompson spoke of the advantage of apprenticeship schools, but said that if such schools were established in England it would be by local, rather than Imperial effort, for they succeeded better when they were not fettered by Imperial legislation. Whatever science teaching existed was not merely a scrap, but part of the organic whole, and this was sufficiently elastic to allow of there being special schools, a building school, a school of carpentry, a school for other kinds of technical education, all having their base in the elementary schools; but there should be more community of idea between the lower and the higher scientific training. Miss Becker had affirmed that children seven years old ought to be able to read perfectly if they were scientifically taught, but they were not scientifically taught, nor did he think the difficulty would be removed until they had done away with the abominable irregularities of the detestable English spelling, and reformed the table book.

The Rev. W. Delaney (St. Stanislaus College, Tullamore) said he should like to change the idea that science was merely the handmaid of education, for he believed it was really the best educational weapon, and as a schoolmaster he valued almost infinitesimally the knowledge that boys and girls, and even university men, carried with them into life. Education hitherto had gone too much in grooves, and what they required was a great improvement in scientific teaching, especially in intermediate schools, where it was in a deplorable state. He found that boys who could learn nothing learn science easily, and that when they had learnt science they could learn other things easily. There was an absolute inutilty and absurdity in teaching grammar in which boys were taught to know the unknown by the unknown, and he found moreover that whilst Latin and Greek were well known in scientific schools, scholars simply studying the classics often failed in that special study, whereas those who studied science as well as classics passed often at the head of the list.

The President (Mr. Mundella) in summing up the discussion, said he believed that science teaching tended to redeem school life from its drudgery and monotony. In the science schools abroad the interest manifested by the children in a proper object lesson, and the facility with which they acquired knowledge, had very much struck him. The step which, above all others,

was the most necessary in education was to awaken the interest of the children in the subject taught. The children would be taught to think for themselves. Therefore, he had always supported science teaching in schools not only for its great utility, but from a belief that if science teaching was coupled with the ordinary literary teaching of schools, a knowledge of the literary subjects would be more easily acquired. It did not surprise him to hear that there was a good deal in our national education system that needed reform. They had just heard from a successful and accomplished teacher in this town that science could not be taught, because the inspectors themselves discouraged the teaching of it. Young gentlemen fresh from the Universities—some of them very accomplished—were made the inspectors of the whole elementary schools in the country, by a system of patronage and not of selection. They were very highly paid, and they were appointed inspectors because perhaps their fathers or near relatives had rendered a service to some particular political party whichever it might be. But that was altogether a wrong state of matters with reference to education. In London he was now constantly hearing a cry as to whether we are not over-educating the people. Although all present might acquiesce to-day in this discussion, throughout society the cry was, "We are over-educating our people." The real truth was, that people had yet to learn to begin to educate children. They were all very proud of what had been done by the Education Act of 1870, and he should be the last man to undervalue that Act. But as for having an educational system, he declared they had none. To begin with, they should have a Minister of Education who would deal with education solely, and who would know something about his business. Education ought not to be mixed up in the Education Department with vaccination and cattle plague, and other things. It seemed that all the heterogeneous things there was no room for in other departments had been sent to the Education Department. He not only supported science teaching in schools, but he wanted to see it carried to a higher state than the mere teaching of it in schools. Should the British Association visit this town some twenty years hence, they might reasonably expect to find "home-bred" scientific men who would appreciate more highly the Association's labours.

Prof. S. P. Thompson read a paper *On Apprenticeship in France*.—The problem to be solved was—how to give that technical training and scientific knowledge to artisan children which their occupation demanded, without detaining them so long at their schooling as to give them a distaste for manual labour. There were four solutions of the problem, all of which had been tried, and illustrations of which could be seen in Paris. They were (1) send the children to work in the factory or workshop at an earlier age, making it obligatory all through their apprenticeship that they should have every day a certain number of hours' schooling in a school in the workshop or attached to it. (2) Keep the children at school as long as their education was unfinished, but set up a workshop in the school where they should pass a certain amount of time every day so as to gain at least an aptitude for manual labour. (3) Organise a school and a workshop side by side and co-ordinate the hours given to study with an equal number of hours devoted to systematic manual labour; and (4) send the children half the day to the existing schools, and the other half to work half-time in the workshop or factory. Schools of the first type had existed in France for nearly thirty years, and at the close of 1878 there were no fewer than 237 schools of this character. So far as he was aware, there was only one school of the second type—the *Ecole communale d'Apprentis*, in the Rue Tournefort, Paris. The peculiarity of this school was that workshop training was being given to lads who had not yet completed a course of elementary education. Of the third type some admirable examples were to be seen in Paris. Some very interesting particulars were given of the progress of the horological school at Besançon. The fourth type or half-time school, which was English in its origin, was rarely to be found in France. Since the old apprenticeship had virtually lapsed, there was nothing to save the young artisan of the rising generation from degenerating into a mere machine, unless a new agency could be practically organised. What was claimed for the apprenticeship school was that its pupils do not possess just a bare minimum of knowledge sufficient to procure them means of subsistence in one narrow department of one restricted industry, but that they possess both manual dexterity and a fair technical knowledge which would enable them not only to earn more and to turn out better work, but also to be less at the mercy of the fluctuation of trade for the means of

subsistence. Besides the new apprenticeship being better for real instruction in technical principles, it was also better for practical work in so far as it shortened the needlessly long years of the apprenticeship, and imparted at an earlier age all the manual capacity that apprenticeship in any form could impart. There were not wanting on our horizon signs of significance in the problem of the relation of science to labour. We had really skilled workmen, and no foreign workmen were their equals, but they were only units in a crowd. Take which view they would, technical education, and above all, the technical education of the artisan classes was a *sine quâ non* of the future industrial prosperity of Great Britain. What steps then must be taken to give effect to the new apprenticeship? Two things would determine the success or failure of the school—(1) the obtaining of the right kind of teachers, and (2) the adoption of a system of instruction based upon drawing, which was the language of the manufactures, the handicrafts, the constructive industries of all kinds. It was evident that the first step would be the foundation of a system for training competent teachers. Then there must be a central technical college, for through such an institution alone could community of thought and method of work be obtained. If such a system of technical education as he pointed out was to be instituted, the nation must move towards its accomplishment with a spirit very different from that in which it had viewed technical education during the last quarter of a century. Crisis after crisis had passed, and capitalists and unionist artisans either would not, could not, or dare not confess that the core of all the rottenness was the failure of the old apprenticeship to cope with the requirements of the age and the new social conditions brought about by the fierce rivalries of industry.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE twenty-eighth meeting of the American Association for the Advancement of Science was commenced on Wednesday, August 27, at Saratoga Springs, N.Y. After the formal opening in the Town Hall, the proceedings of the first day were mostly concerned with organisation. We give below, in part, the address of the retiring president, Prof. O. C. Marsh, which was delivered on the evening of the 28th, and we hope shortly to offer further intelligence of the scientific work of the meeting.

The new President is Prof. George F. Barker, of Philadelphia; the Vice-president in Section A (comprising Mathematics, Astronomy, Physics, Chemistry, and Mineralogy), Prof. Langley, of Alleghany; and that in Section B (Geology, Zoology, and Botany), Major Powell, of Washington. Prof. Clarke was chairman in Chemistry (sub-Section C), Dr. Morley in Microscopy (sub-Section D) and Dr. D. Wilson in Anthropology (sub-Section E). In addition to the presidential addresses and ordinary work of the sections, we note from the programme that Dr. Edison was to give, on the Saturday evening, an illustrated paper on "The Electro-Chemical Telephone;" while Monday evening was to be devoted in general session to hearing three papers by Professors Chandler, Hall, and Hunt on the mineral waters of Saratoga. There is a goodly list of over 150 papers to be read before the various sections (and it is, by the way, a commendable feature, that the time each would occupy in reading is exactly stated). The following are, briefly, some of the subjects:—In Section A: Experimental determination of the velocity of light (Michelson); Cooling of the sun and the earth (Peirce); Solubility of ozone (Leeds); A general law indicating the location of planets, satellites, or annular rings round their primary (Marsden); Metrology and the progress of science (Barnard); Double stars (Hall); Identity of lines of oxygen with bright solar lines (Draper); Binaural audition (Bell); Conversion of mechanical energy into heat by magneto-electric machines (Barker); Phenomena of heating metal *in vacuo* by means of an electric current (Edison); Influence of light on electric conductivity of metals (Wright). In Section B: Succession of glacial deposits in New England (Upham); Histology of insects (Minot); Conditions to be fulfilled by a theory of life (Minot); Philosophy of the pupation of butterflies (Riley); Consonantal expression of emotion (Blake); Microscopic crystals in the vertebra of the toad (Bolton); The inter-oceanic canal problem (Lull); Bornean oranges (Hornaday); Objects of sex and of odour in flowers (Meehan); Remarkable crinoidal form recently found in Tennessee (Safford); New unpolarisable elec-